SESSION XV
COMPLIANCE THROUGH P^2 INITIATIVES

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Beyond Compliance: Use of P2 and Process Change to Achieve Facility Deregulation

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Introduction

Pollution prevention (P2) has evolved over the past decade. Ten years ago most facility managers pursued P2 initiatives simply to reduce the quantities of wastes produced. As toxic release inventory (TRI) numbers became widely available and interpreted by the public, additional pressure was brought to bear upon facilities to "reduce their numbers." As P2 efforts continued, a new significant benefit began to emerge, one that is now being realized as a most potent driving force for even more P2 initiatives. That benefit is deregulation, or removal of the facility from the regulatory arena, by using P2 and process change.

The idea of regulatory relief stemming from P2 efforts is supported through examination of individual environmental media. Eliminating use of toxic chemicals eliminates requirements for employee exposure monitoring under occupational safety and health laws. Eliminating water and air emissions eliminates the need for environmental construction and discharge permits. Eliminating generation of solid and hazardous wastes eliminates regulatory record keeping, regulatory enforcement inspections, and legal liability for waste handling and disposal.

This paper demonstrates the approach to achieving facility or installation deregulation through extensive use of pollution prevention techniques and process change. The approach is developed from observation of private sector facilities; parallels are drawn to federal facilities as well. The paper presents data from several industrial case studies in which facilities achieved significant or total deregulation by a combination of P2, process change, and reengineering.

Deregulation of a Process through Administrative Changes

In the early 1990s an initiative was begun to prevent accidental releases of certain chemicals stored and used in "stationary sources" such as manufacturing operations. When Congress amended the Clean Air Act in 1990, legislators included accidental release prevention requirements; following the Congressional mandate EPA promulgated the Risk Management Plan (RMP) rule. This rule requires an analysis of potential release mechanisms and their effects on "public receptors". It also requires that a program be put into place to prevent accidental releases and to mitigate the effects of any releases that do occur. The deadline date for stationary sources that are "covered" by the rule to have a program in place and electronically filed is June 21, 1999, and plans must be reviewed and updated every five years.

The RMP rule sets specific definitions for determining whether a process is covered under the rule. For example, the rule states that a stationary source that uses, processes, or stores more than a threshold quantity of a regulated substance in a process at one time is covered.

Stationary sources include those sources present at federal installations and private sector sites, including manufacturing and processing areas , storage areas, water and wastewater treatment facilities, and others. There is a list of regulated substances (some mandated by Congress, others listed by EPA) that are of concern as to the potential for their release. The substances on the list are classified as toxics (gases or liquids), flammables, and explosives. Common chemicals which are regulated substances include propane, chlorine, and ammonia. The rule establishes a "threshold quantity" of each regulated substance, above which quantity the rule applies. A process includes actual process units as well as associated vessels and piping. The idea is that, should an accidental release occur, the associated piping and vessels are subject to having their contents released. Many federal installations have several "covered processes" on the installation; for those that do, a single RMP document that addresses all of the covered processes is required.

The judicious application of P2 and administrative controls can minimize an installation's "coverage" in the RMP program. For example, a change from a regulated substance as a raw material to an alternate substance that is not regulated will remove a process from coverage. As another example, if an installation has a process with storage vessels that can contain such quantities of a regulated substance that the process would be covered, installation personnel may be able to apply administrative controls to the process. Administrative controls ensure that the amount stored and in process at any one time is always less than the threshold quantity. For gases, administrative controls may include pressure regulation; for liquids, level controls. In both cases, the automatic controls serve to maintain the stored quantity of the regulated substance below threshold quantities. In many cases, a simple written policy appended to the installation environmental management (information) system (EMS or EMIS) suffices.

The initial cost savings (not including the five-year updates) attributable to elimination of a process from RMP requirements can vary widely depending upon the complexity of the process and modeling requirements. Examples observed to date range from savings of approximately $2,000 for a simple propane tank to more than $20,000 for a complex process involving chemical reactors.

Deregulation through a Change in Paint Process

Frigidaire Home Products, a subsidiary of AB Electrolux—a large maker of household appliances—employs 1,100 people in a refrigerator manufacturing plant at Anderson, South Carolina. Until recently appliances and components produced at the facility were painted using traditional solvent-based coatings.

After considerable research and testing, the company converted to a powder-coating system for painting the refrigerator and freezer doors. Frigidaire invested $1.5 million in this effort and, as a result, the facility completely eliminated all wet paints and related solvents, volatile organic compounds (VOCs), and hazardous air pollutants (HAPs) from the painting process, thereby eliminating all hazardous wastes.

The deregulation benefits to the facility are in two general areas:

- The facility has changed from "large-quantity generator" status to a "conditionally exempt small-quantity generator."
- The facility avoided a costly Title V air permit application and all of the regulatory burdens and related impediments; the facility holds "conditionally exempt" status.

A substantial amount of the $1.5 million cost will be recovered in the first year alone, representing a payback period of one and one-third years. The accompanying direct savings come from an array of sources: reduced service calls, lower raw-material costs, nonexistent waste-disposal costs, fewer defective parts, and lower energy and operating costs.

The powder-paint project has had a profound impact in several ways. In the area of hazardous waste, as stated earlier, the project has enabled Frigidaire to become a conditionally exempt generator (previously a large-quantity generator) as the company no longer generates any hazardous waste requiring disposal. Even the nonhazardous wastes, such as the paint filters that were normally destined for a secured landfill, are no longer present. In addition, the wastewater treatment process benefited from the process change through the elimination of the risk of solvent spills into the sewer. The plant is also successful in complying with all the requirements of the sewer-use permit, and it has vowed to continue its waste minimization efforts by exploring a "zero discharge" status in the plant's process effluent.

The "indirect" or regulatory relief cost impacts are significant. Estimates made by plant environmental staff are that the change from large to small quantity generator of hazardous waste saves the facility approximately $10,000 per year in monitoring, paperwork, and related costs. Similarly, the change to a conditional major in the air program has saved an additional $40,000 in permitting and monitoring costs.

Deregulation of a Facility through P2 and Reengineering

MEMC Electronic Materials, Inc., manufactures polished and epitaxial silicon wafers [epitaxial or "epi" wafers are a value-added product where the surface of a polished wafer receives a thin layer of ultra-pure silicon]. Silicon wafers are the substrate, or base, on which microelectronic circuits (microchips) are built. The primary product of the MEMC manufacturing facility in Spartanburg, South Carolina, is the 150-millimeter diameter polished silicon wafer. Process operations at the Spartanburg plant involve silicon crystal growth and wafering.

MEMC's business is characterized by short product life cycles, stringent product quality specifications, and continuous investing in new manufacturing technology to keep pace with customer requirements. In a dynamic environment like this, it is realized that capital spent on end-of-pipe pollution controls to comply with environmental laws represents capital not available for improving product quality or expanding manufacturing capacity. In 1989 MEMC realized that the traditional "tail pipe" approach to managing environmental regulations was not economically sustainable.

The company established the following environmental goals and deadlines in 1989:

- Reduce hazardous air emissions by 80 percent by year-end 1994.
- Eliminate the use of ozone-depleting chemicals (ODCs) by year-end 1995.
- Reduce the generation of priority waste by 50 percent by year-end 1996. (*Priority waste* includes hazardous waste and nonhazardous recyclable materials that are landfilled.)

The base year for these goals was 1988, and the 1989 goals reflect environmental issues that had the greatest impact on MEMC operations at that time. Where possible, the goals were to be

achieved by waste elimination rather than with end-of-pipe pollution controls.

As discussed further below, MEMC achieved success in meeting the goals set in 1989, and set an additional series of goals to be met by the end of 1997:

- Reduce the remaining hazardous waste generated by 70 percent (1991 base year);
- Reduce the solid waste landfilled by 50 percent (1991 base year); and
- Reduce the emissions of criteria air pollutants by 25 percent (1993 base year).

In 1994, the plant underwent "re-engineering." A number of projects selected for implementation included waste elimination and the improvements in resource efficiency.

The major projects undertaken by the facility staff related to P2 and deregulation from 1988 through 1997 included the following:

- Reduction and later elimination of chromium-based etchant solutions.
- Reduction and later elimination of all use of chlorinated organic solvents, including ozone-depleting substances.
- Solid waste recycling program.
- Boiler fuel conversion from fuel oil to natural gas.
- Package redesign for reuse.
- Water reuse program.

Cumulative waste reduction and regulatory relief achieved by pollution prevention projects at the plant are discussed below.

Hazardous Waste. The solvent-use elimination project was completed in 1993. No hazardous waste solvents were generated by manufacturing operations in 1994, 1995, and 1996. The chrome-use elimination project was completed in 1995. During 1996, no RCRA-regulated hazardous wastes were generated by manufacturing operations at the plant. In 1988, the plant had interim status as a RCRA Treatment, Storage, and Disposal (TSD) facility for greater-than-ninety-day storage of hazardous waste. At that time, MEMC felt this was the most practical way to manage the large quantity of hazardous waste generated by manufacturing operations. In 1990, the facility received a final RCRA Part B permit for container storage of hazardous waste. The final permit was forty pages with more than 200 specific conditions. The experience of the RCRA permit demonstrated the large administrative effort necessary to obtain a major environmental permit and to maintain compliance with permit conditions.

In 1991, South Carolina imposed new site-location and risk-assessment standards for RCRA TSD facilities. The new standards were retroactive and would require the plant to upgrade its two RCRA-permitted hazardous waste storage pads. As a result, MEMC determined TSD facility status was no longer economically justifiable. In August 1991, the plant ended greater-than-ninety-day storage of hazardous waste and operation as a RCRA TSD facility. This change was possible due to success of the chrome- and solvent-use reduction projects completed in 1990.

By 1994, MEMC Spartanburg reduced manufacturing generation of hazardous waste by more than 96 percent compared to 1988. In March 1994, the company officially closed its two RCRA-permitted hazardous waste storage pads and was released from financial assurance requirements for closure and post-closure care. The chrome-use elimination project completed in 1995 ended

all manufacturing generation of hazardous waste at MEMC Spartanburg. The plant became a small-quantity (less than 1,000 kg per month) hazardous waste generator. In February 1996, MEMC was officially released from all TSD facility portions of its RCRA Part B permit.

The experience of obtaining and then eliminating the RCRA Part B permit convinced MEMC that major environmental permits should be avoided wherever possible. The administrative time and cost to eliminate TSD portions of the RCRA permit were even more than the effort initially required to obtain this permit.

Air Emissions. Chlorinated solvents and associated air emissions and hazardous waste generation were eliminated from the plant in 1993. The small quantity of solvent used in manufacturing after 1993 was isopropyl alcohol (IPA). Boiler fuel conversion and elimination of acetic acid epoxy removal reduced criteria pollutant air emissions by 77.1 percent between 1993 and 1997. This accomplishment far exceeded the 1994 MEMC goal for a 25-percent reduction by year-end 1997.

The 1990 Clean Air Act (CAA) Amendments substantially changed industry management of air emissions. Prior to the CAA, major air pollution source designation was based on actual annual emissions of criteria air pollutants. The definition of "major source" was the same regardless of location in the United States. Air toxics were not included in the definition of major air emission source. After 1990, major air emission sources were defined by potential-to-emit rather than actual emissions, major source thresholds for criteria pollutants were based on ambient air quality, and air toxics emissions were added to criteria pollutants for major source determination.

Permit application, air quality modeling, and public review requirements for major air emission sources under the 1990 CAA are substantial. In South Carolina, major air emission source permits typically require twelve to eighteen months to obtain. In contrast, minor air emission source permits (regulated by state law) can be processed in sixty to ninety days. The Spartanburg plant was a minor air emission source prior to 1990. The facility managed actual criteria pollutant air emissions to stay below source thresholds.

In 1991, MEMC management realized that the Spartanburg plant would become a major air emission source under the 1990 CAA unless substantial changes were made. It was not acceptable for environmental permitting to delay manufacturing process changes needed to meet customer requirements. Such delays were likely if the facility was required to file for a Title V air quality permit.

The solvent-use elimination project completed in 1993 avoided major source designation for air toxics by eliminating chlorinated solvent air emissions. Boiler fuel conversion, completed in 1995, reduced the plant's potential-to-emit SO_x and NO_x below major source thresholds. These changes allowed MEMC Spartanburg to remain a "minor" air emission source regulated under state and not federal law. Elimination of acetic acid epoxy removal in 1996 further reduced plant VOC air emissions. MEMC Spartanburg submitted its "Conditional Major" (synthetic minor) air quality operating permit application in November 1995. The application provides reserve capacity for manufacturing expansion and process change without triggering major source thresholds under the 1990 CAA.

The experience of preparing for implementation of the 1990 CAA demonstrated that waste elimination can avoid major environmental permits and associated delays for regulatory review.

Solid Waste. Between 1990 and 1996, MEMC reduced plant trash landfilled by more than 64 percent. This exceeds the 30 percent landfilled waste reduction goal in the 1991 South Carolina Solid Waste Policy and Management Act. The landfilled waste reduction since 1991 is more than 50 percent, which exceeded the 1994 MEMC environmental goal. Between 1993 and 1996, the plant increased the recycling rate by weight from 44 percent to 59 percent.

MEMC Spartanburg cannot operate without access to local landfills for nonhazardous solid waste disposal. Solid waste recycling efforts helped insulate the plant from landfill price increases and restrictions resulting from implementation of the 1991 Solid Waste Act. For example, it is now illegal in South Carolina to landfill wooden pallets unless they are shredded. MEMC had a program for the in-place recycling of wooden pallets before the landfilled "pallet ban" went into effect.

Occupational Safety and Health. Waste elimination also brings regulatory relief under occupational safety and health laws. The use of toxic chemicals in the workplace is strictly regulated. These rules specify permissible exposure limits (PELs) and require monitoring of industrial hygiene to verify that legal maximums are never exceeded. The rules may also require process ventilation, engineering controls, personnel protective equipment (PPE), hazard communication, special employee training, medical monitoring, and long-term retention of medical records and industrial hygiene sample results. The solvent-use elimination project completed in 1993 eliminated legally required engineering and administrative controls for chlorinated solvents. The chrome-use elimination project completed in 1995 eliminated similar requirements for hexavalent chromium.

Conclusion

This paper has shown how several facilities have used pollution prevention principles to gain an advantage that was unrecognized by many until recently. These facilities have shown that process changes for the elimination of waste and the improvement of resource efficiency can help avoid environmental permits and reduce the burden of compliance with environmental laws.

Regulatory relief gained from pollution prevention projects can provide reserve capacity for manufacturing expansion without triggering new, major environmental permit requirements. This flexibility for quick implementation of manufacturing process change is an important competitive advantage. It enables any industrial facility or federal installation to respond rapidly to changes in market demand or mission readiness.

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